

Solar-like Oscillations in Eclipsing-Binary Systems

Patrick Gaulme

New Mexico State University

We propose to use K2 unique capability to detect solar-like oscillations of main-sequence and red-giant stars that belong to well-known eclipsing binaries. This proposal follows those submitted for K2 fields 0, 1, and 2. In Field 0 (GO0073), we were awarded one short-cadence and three long-cadence targets. In Fields 1 and 3 (GO1034 & GO3064), our two submitted targets were selected for short-cadence observations (no submitted targets in Field 2). Decisions regarding Fields 4 and 5 are pending. This document is an overview of the proposal that will be submitted by February 27.

Binary systems hosting at least one star with detectable solar-like pulsations are becoming important astrophysical targets because they provide a way to calibrate asteroseismology. As illustrated by the CoRoT and Kepler missions, asteroseismology is an efficient method to measure masses, radii, and ages of large numbers of stars, which is of prime importance to test stellar evolution. However, a crucial test of both asteroseismic masses and radii of a large sample of stars with independent measurements of those quantities has not yet been carried out. Eclipsing binary systems (EBs) potentially permit such an exercise by allowing for accurate determination of masses and radii of both stars by combining photometric and radial-velocity measurements, provided that spectral lines are detectable for both components. EBs are also interesting for the physical processes resulting from tidal interactions, which may influence their evolution when the stars are close enough (e.g. Gaulme et al. 2014). So far, all the published stars known to both display solar-like oscillations and belong to EBs are red-giants (RGs), and all have been detected by the Kepler mission. The first detection was the 408-day period system KIC 8410637 (Hekker et al. 2010, Frandsen et al. 2013). Since then, Gaulme et al. (2013 & 2014) reported a list of 18 bona fide new RG eclipsing-binary candidates, of which 14 displayed oscillations. More recently, Beck et al. (2014) reported the discovery of 18 new heartbeat stars, where each system has a RG component with oscillations, and three are also EBs. Provided that oscillations are detected, observing known EBs with K2 is a unique opportunity to extend the sample of systems to test asteroseismology.

The purpose of this GO proposal is to observe a small set of eclipsing binaries that are already well characterized in terms of physical parameters (orbits, masses, radii). Doing so present two main advantages. Firstly, observing well-known systems helps predicting the likelihood of detecting solar-like oscillations. Secondly, the objective is to reduce the burden of ground-based follow-up, which is very time-consuming when radial-velocities need to be measured. The target list is obtained by pre-selecting systems from the General Catalog of Variable Stars (GCVS), then by checking the available literature. A set of eight targets has been identified in K2's fields 6 and 7.

Funding will be requested to pay a graduate student for a 1-year and two trips to Europe, where most of the asteroseismic conferences/workshops are held.

References

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